

THE 509TH COMPOSITE GROUP AND OAK RIDGE

PARTNERS AT HISTORY'S CROSSROADS

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[During the Manhattan Project (from May 25, 1943) a Jr. Chemist, Tennessee Eastman Corp., Y-12 Plant]

The Keynote Address to the 200 Attending the Final 509th Reunion at Oak Ridge, TN, Saturday Evening,
October 5, 2002

Tonight I'd like to share two stories, first something about what we were doing here in Oak Ridge while you were doing your things at Wendover, Cuba, and Tinian, and second about how the last part of our precious uranium-235 product got to you on Tinian to go to Hiroshima.

But first I must say what a delight it is to welcome back Dutch Van Kirk! Our city opened its heart to him when he visited here in June, two years ago. His inspiring talks to us about the mission of the 509th brought standing room crowds to their feet in tribute! So it's grand to have a chance to again pay tribute to Dutch and now also to all of you others of the 509th and your families!

What a colossal accomplishment that Manhattan Project was that we were both privileged to serve. Our 15-mile long, 6 to 7 mile wide reservation here in East Tennessee then was called by the code name *Clinton Engineer Works*, the name Oak Ridge was not widely used till after the war. Our major mission here was to separate the uranium isotopes – the two forms of uranium with slightly different weights that occur in nature. Back in 1939 when Hitler started WWII by invading Poland, scientists began kicking around the possibility that an atomic bomb with awesome power might be built if someone could just figure out a way to get a lot of nearly pure U-235, the lighter of the two forms of uranium that's dug out of the ground. The heavier one is U-238, very little heavier. Isotopes can't be separated like you separate iron from iron ore; they behave identically in all chemical reactions. You have to work on their trivial difference in weight, and that's pretty small. Suppose we use two basketballs to represent uranium atoms, then the heavier U-238 will be identical except that it weighs the amount more than it will if you tape a five-cent piece to it! And then if separating them isn't hard enough, U-235 is scarce as hen's teeth! In every 1000 pounds of uranium you dig out of the ground, there are only 7 lbs of 235; 993 lbs of U-238 –intimately mixed.

When the Manhattan Project started in the summer of 1942, Gen. Groves had three universities telling him: "Well, we think we know a way you might be able do it." He was horrified by the uncertainty. By December 1942 he and his advisors reduced the field from three to two by stopping all work on one of the three ideas - the gas centrifuge, which interestingly 60 years later in 2002 is now the process of choice in the U.S.! The scientists could still not assure the success of either of the other two: the electromagnetic approach and gaseous diffusion, so Groves decided they would have to go ahead and build both. The fear that the Germans might succeed with their efforts was the major decision driver.

In September of 1944 when the 393rd bomber squadron was first settling in at Wendover, here at Oak Ridge our brand-new town had been built and running night and day for a whole year. The first 400 million dollar U-235 separation plant, called Y-12, had been running since January

1944, about 9 months, but sure hadn't produced any baby! Y-12 used over a thousand big devices called Calutrons in nine big buildings that produced separation when the uranium isotope mixture was driven through a very strong electro-magnetic field. After each had run a week or so it ran out of feed and had to be stopped, the little bit of product removed, recharged and restarted. And the product was only partly enriched, so it had to be put through again to get bomb grade fuel. The calutron magnets were enormous, and copper to wind their coils with was in very short supply, so Y-12 borrowed silver from the U.S. Treasury to use instead of copper so it, like Lucky Strike's "Green", could go to war! We borrowed 13,500 tons of silver worth more than \$300 million to make the magnets and stripped it out and gave it back to the Treasury after the war! The magnetic field was so strong it would jerk an ordinary wrench right out of your hand if you walked within a few feet of the machines! We had to use non-ferrous tools.

So while some of you were first discovering the delights of Wendover in October 1944, there were 22,000 of us, me included, working 24/7 at Y-12, and we still had not separated enough U-235 nor gotten it pure enough for Los Alamos to make a bomb!

Though almost all of Oak Ridge's effort was spent on making U-235 for Little Boy, we do have a tie with you and the Nagasaki plutonium bomb, Fat Man. The tie is through the Graphite Reactor that you visited yesterday. It was the world's first real nuclear reactor, built here in Oak Ridge and started up in November 1943. By the time you got into business at Wendover, it had been running smoothly for a whole year making small quantities of the new element plutonium so that chemists could find ways to handle it when they got the big production reactors running at Hanford.

Meantime Y-12 had major startup problems, so General Groves kept the heat on the construction of his back up, another entirely new technology, \$500 million plant called K-25 that employed a very different approach called gaseous diffusion. It sure sounded easy: all one needed to do was to make some gaseous form of uranium seep or diffuse through a porous, sieve-like membrane or barrier, and a little bit more of the U-235 will diffuse through. Because their molecules are a little lighter, they zip around a little faster than the U-238s. But the secret of how to make a really workable porous barrier had eluded scientists who started working on it in 1940! For one thing, all the holes in the membrane had to be microscopically small, so small that there could be hundreds of millions of holes in a square centimeter, the size of your thumbnail, and they had to be all the same size, not too big, not too small. But even if you can make the perfect barrier, you get such a little separation each time it diffuses that you have to pump up the gas again and pass it through another barrier almost 3,000 times to get the purity of U-235 you need! We're talking about a big operation! The gigantic K-25 building was 400 feet wide, a mile long, with 40 acres under roof- at that time the largest building in the world. It was chuck full of vacuum-tight pipes, pumps and tanks to hold the barrier, and is located out in the western end of our reservation where the Secret City Train Ride is that some of you went on this afternoon.

That colossal plant in the fall of 1944 was a great engineering marvel full of innovations, but it couldn't be started because no really good barrier was on hand. Talk about nail biting! Fortunately by December when the 509th was officially activated at Wendover, a way to make a workable barrier was developed, and the first uranium gas was put in the plant in January 1945 about the time some of you went down to Batista Field in Havana. It was to be months before useful enrichments would be reached, so K-25 with its 11,000 workers contributed only in a minor way to Little Boy, but during the postwar arms race the plant was greatly expanded and continued to work superbly for many decades, not being finally shut down until 1985.

In the early spring of 1945 Y-12 was operating smoothly, like everyone had hoped it might, finally sending enough nearly pure U-235 to Los Alamos so they could finalize the design and plan how to make the U-235 parts for Little Boy.

So much for what we did at the plants. What was life like after work? I really enjoyed looking at the brochure of your last reunion with your personal stories and the pictures of Wendover. I couldn't help but wonder if maybe some of the same guys that built your base came down here and built ours! You've been here three days and seen something of our town, but believe me Oak Ridge in the fall of 1944 looked entirely different than it does now. Today our little city of 27,000 is a sleepy little town compared to the city of 75,000 that then ran full-throttle all night as well as all day. Our town then looked just like what it was – a big, brand new army base, built fast to do a particular job, not to last much past the war. The army engineers built miles of fences, guard posts, nearly 10,000 homes for families; 90 two story dormitories for 13,000 singles like me; 5,000 trailers, 16,000 hutments and barracks spaces for construction workers and soldiers; 2 chapels, 9 neighborhood schools, a hospital, rec halls, a dozen shopping centers, a big bus system, and all the rest. In addition to 75,000 residents in town, we had thousands of commuters and construction workers who came in for their three shifts.

We maybe had one thing you didn't – major rainstorms! Yankees like me soon learned why native Tennesseans called them “frog-stranglers”. Rain turned our thinly graveled roads into seas of sticky, slimy, slippery mud. That accounted for one unusual feature of our town – its miles of boardwalks instead of sidewalks! At Y-12 I had to keep a clean pair of shoes to change to from the galoshes I wore in wet weather before going into the chemistry building.

What you had that we didn't was your extreme isolation, your salt flats, winter trips to the Caribbean for some, and that bar, grill, and casino so close-by at The Stateline Hotel. We would have really loved that because this land the army bought here was in two Tennessee counties that had “bone-dry” laws, meaning it was against the law to have any alcohol here! All we could get was that same worthless 3.2 belly wash beer you also had in your PX! Legally bone-dry, that is, we had to drive a long way to buy any booze, pay through the nose for it, and then smuggle it in!

Otherwise, I suppose, our lives after work were much the same as yours: shortages of whatever you really wanted, long lines, ration books, and those same temperamental coal stoves that now and then blew up. In the fall of 1944, we were both reading in our newspapers the dreadful news about the Battle of The Bulge and invasion of the Philippines and huddling around radios at night to hear more from Lowell Thomas, Gabriel Heatter, and Edward R Murrow. And always, in our plants and in town, there was the ever-present insistence on very tight security – don't talk about what's going on here!

Keeping a secrecy rein on the people here in 1945 was a real challenge; we probably couldn't do it as effectively with our 35,000 plant workers as you did with your 1,800. We had the same security briefings and slogans on billboards you had, but aggravating the problem here was our short 13 miles to Knoxville where Ridgers went to shop as often as they could. Ridgers outside the base could be easily spotted from our muddy shoes, and you'd often get quizzed by friendly but so curious outsiders with questions along this line: “Gosh, that's a huge operation out there, whatever are you guys making?” We got pretty creative in our answers, and our panel last night mentioned a few. Some others I remember were: —“Oh, we're just building a bunch of homes for all the officers to come retire in after the war.” —“Why, we're making campaign buttons for FDR's fourth term and luggage for his globetrotting Eleanor.” I heard about one guy that said: “Shoot, I don't mind telling you what I'm making out there– it's \$1.17/hour.” My favorite was the good ol' Tennessee maintenance man at Y-12 who said: “Well, frankly I don't know what

they'se makin', but I'll tell you this much – the govmint could sure as hell go buy it somm'ers else a whole lot cheaper!”

In April of 1945 when General Groves and the scientific brain trust came through the plant they were smiling for once; no longer chewing nails and parts of people's anatomy! The smiles meant it looked like we were going to meet that near impossible target of having enough U-235 for a bomb to be ready in late July. Early in May most of you 509th were packing your gear and getting ready for your three-week sail to Tinian on the “Cape Victory”. In early June, your fine B-29s got to Tinian, and you were all set. At Y-12 we were sending every milligram of U-235 we could find out to Los Alamos, production was higher than ever and rising every month, we were going to meet our schedule, but there were not going to be any spare parts for Little Boy!

And that brings us to my second story about how the last of our U-235 got to you on Tinian. I'm afraid none of our townspeople would have judged the huge Y-12 plant was a great success if they had been told that all of its product could be hand carried out by a couple of lieutenants each week! It was a relatively small amount, that highly pure U-235!

Incidentally, we made none of the Little Boy bomb parts here. All of Y-12's wartime product was shipped out to Los Alamos in the form of fine crystals of U-235 tetrafluoride, a pretty blue-green powder! No, it does not glow in the dark! Its radioactivity will not penetrate the skin, so you can safely hold several pounds in your hand, but *it sure was* precious. It had cost well over 100 thousand dollars an ounce to make it! Y-12 chemists packed it into a container about the size of a coffee cup made out of nickel and heavily plated with gold on the inside so the costly green powder would not get contaminated and then have to be re-purified by Los Alamos. After putting on covers, two of these cans were packed in a wooden frame in a very ordinary looking leather attaché bag like businessmen carried in 1945. This super valuable briefcase was then chained to the wrist of a lieutenant in military security wearing civilian clothes and off he went with armed escorts by train to Chicago and then took the Santa-Fe *Chief* out to New Mexico.

Well, it was not long before the August climax of all our efforts, that one of Oak Ridge's military security couriers, Lt. Nick Del Genio, opened orders and found he was to carry one of these routine shipments to Los Alamos. It was on a Monday, July 23 and he got there Wednesday the 25th and made his delivery. Nick then opened his return orders and learned that instead of coming back to Oak Ridge he was to leave the 26th, the next day, on a top-secret trip of 6,000 miles out to Tinian Island. Nick was given custody of a 2 ft. high steel can about 1 ft in diameter and was told –“don't let this out of your sight until you deliver it to the agent assigned on Tinian.” He learned later that this was one of three shipments of U-235 target rings. These were the last parts needed for Little Boy. There were no extras. Each of the three final shipments went separately in one of your fine Green Hornet C-54s. The same day they left Albuquerque, July 26th, the Navy's cruiser *Indianapolis* had dropped anchor off Tinian having brought the gun assembly for Little Boy and the U-235 projectile that got fired into the nest of target rings to make the atomic explosion.

The U-235 from Oak Ridge that had cost 60 cents of every dollar spent on the Manhattan Project was finally assembled on Tinian by the Project Alberta team from Los Alamos. They reported to General Farrell and Admiral Purnell on Wednesday August 1 that Little Boy was ready. Your orders came the next day from Secretary of War Stimson's office to make the drop August 6th, and the 509th was now on center stage. You did your part and made history for all the rest of us.

How did we here in Oak Ridge react? With the same incredible surprise of the rest of our country! Nobody I knew here gloried in the 100,000 Japanese deaths at Hiroshima any more than we gloried in the deaths of that same number in the firebombing of Tokyo a few months before

on the night of March 9/10th. No, what we did take great pride in was that the shock of our Manhattan Project's success finally caused their reluctant emperor to stand up to his die-hard militarists and insist on bringing their war to an end at last. And that great pride in the success of our efforts turned to exuberant joy a week later when we Oak Ridgers awoke the morning of August 14th to see the headline in our Knoxville newspaper. That landmark edition was printed on red paper and carried an 8-inch tall banner headline: P E A C E !

And so it was that the 509th took the product of our 2.5 years of dogged 24/7 efforts and made us a vital part in helping to stop the killing of the most terrible war in history, a six-year world war that had involved an incomprehensible total of 54 million people killed by other humans! And the blessed peace all of us had worked and prayed so long and so hard for was at last a reality.

Shortly after the war, I'm proud to say Oak Ridge led the way in making peaceful applications of atomic science using our Calutrons and our Graphite Reactor to produce radioactive and stable isotopes that have brought the world so many benefits in medicine, agriculture, and industry; benefits we still enjoy today. And later Oak Ridge again led the way in giving to the world nuclear research reactors and then nuclear power plants whose clean electric power - though not yet accepted by the public in this country - has been welcomed and beneficial to so many countries of the world including Japan, our war-time enemy but for a half century since, our good friend. These peaceful uses of atomic energy, together with the blessed freedom from WWII for well over half a century, these are the rich legacies of our Manhattan Project.

What a treat it has been for us to have all of you come here where the Manhattan Project began its work 60 years ago just last week, so that we can personally say thank you for being partners with us at history's crossroads.

May God continue to bless all of us and this country we have loved so much. Thank you.

